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Egg Masses and Larvae of Three Species of *Cerithium* from the Arabian Sea

by

SOHAIL BARKATI AND MUZAMMIL AHMED

Institute of Marine Biology, University of Karachi, Karachi-32, Pakistan

Abstract. An illustrated account of breeding habits and early larval development of three species of *Cerithium* from the coast of Karachi, northern Arabian Sea is given for the first time. *Cerithium morus* was studied earlier from tropical waters; however, the habits and development of the other two species, *C. sinensis* and *Cerithium* sp., are described here for the first time. *Cerithium morus* and *C. sinensis* deposit egg strings from which veligers hatch, whereas *Cerithium* sp. is ovoviviparous.

INTRODUCTION

THE BREEDING HABITS and larval development of gastropods of the genus *Cerithium* have only occasionally been studied. This work has been done on species found in the north Atlantic and Pacific Oceans by the following workers: LEBOUR, 1945; OSTERGAARD, 1950; FRETTER & GRAHAM, 1962; DAVIS, 1967; WOLFSON, 1969; D'ASARO, 1970; HOUBRICK, 1971, 1973; and CANNON, 1975. NATARAJAN (1957) has described the egg masses of *C. morus* from the Indian Ocean, and LO BIANCO (1888, in HOUBRICK, 1973) studied the egg mass of *C. vulgatum* from the Mediterranean Sea. Members of the family Cerithiidae are fairly abundant on the rocky beaches near Karachi, Pakistan. The present paper describes the breeding habits and early larval development of three species of *Cerithium* from this coast.

MATERIALS AND METHODS

Specimens of three species of *Cerithium* were collected from the rocky beaches at Manora and Buleji (see BARKATI & AHMED, 1983, for ecological notes on these beaches) in the Karachi area. Collections were made at regular biweekly intervals from July 1976 to June 1977. After each collection, specimens were placed for spawning in 1600-mL finger bowls in which water was changed daily and aerated continuously. The temperature of seawater in the bowls in the laboratory ranged from 28 to 31°C. All three species spawned to one extent or another in the laboratory. A microscopic study was also made of the larvae and juveniles that hatched from the egg masses or from individuals. Dimensions of the shells of the developing larvae were measured with an oculomicrometer, and illustrations were prepared with a camera lucida.

OBSERVATIONS

Breeding Season

Cerithium sinensis occurs fairly commonly on the rocky coast at Buleji (near Karachi) near the low-water mark, at a tidal height of about +0.15 to 0.3 m; at this level the snails are exposed only at very low tides. In the laboratory, specimens of this species deposited egg masses on the following dates: June 20, July 3, October 26, 29 and 31, November 1 and 11 in 1976, and July 25, 1977. In addition, two egg masses of this species were collected from the rocky beach at Paradise Point and Buleji on December 7 and 20, 1976.

Cerithium morus occurs on the same rocky beach (at Buleji) as *C. sinensis* but higher up at a tidal height of about 0.9 to 1.5 m. It is one of the most abundant species of gastropods on the open rocky coast of Karachi. Specimens of this species deposited egg masses in the laboratory on the following dates during the year 1976: June 7, September 4, October 19, 22, 30, and 31, and November 1. Altogether, 10 specimens which had been collected from Buleji and Manora spawned in the laboratory.

Cerithium sp. also occurs in the mid-tidal zone of the rocky beaches at Manora and Buleji, but it is less abundant than *C. sinensis* and *C. morus*. This species remains unidentified so far; however, voucher specimens of this species have been retained at the Institute of Marine Biology, University of Karachi, for future studies. In the laboratory, *Cerithium* sp. liberated a few juveniles on October 14.

No spawning occurred in months, other than those indicated, although specimens of all three species were examined for spawning throughout the year.

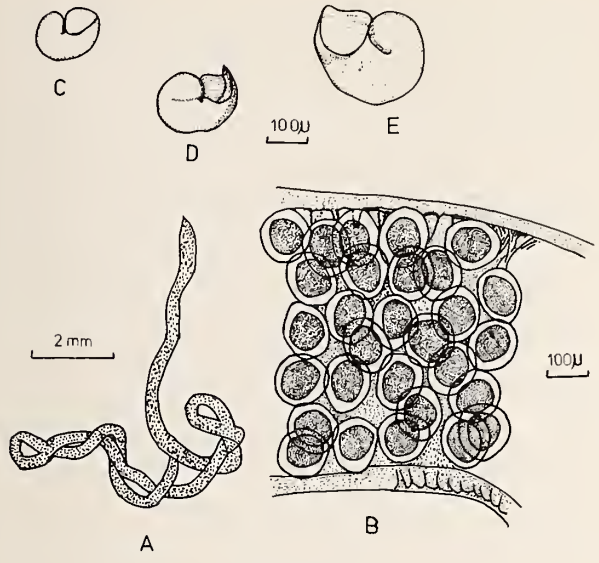

Figure 1

Cerithium sinensis: A. top view of an egg mass; B. portion of an egg mass enlarged; C. ventral view of newly hatched larval shell; D. ventral view of 24-h veliger shell; E. dorsal view of 48-h larval shell.

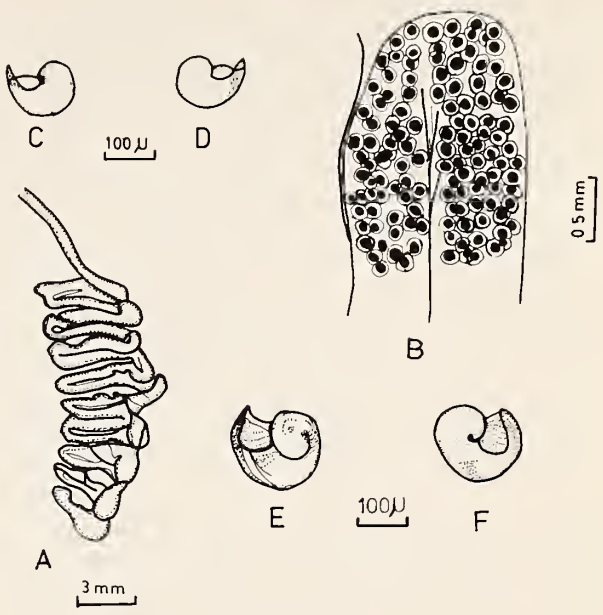

Figure 2

Cerithium morus: A. top view of an egg mass; B. portion of an egg mass enlarged; C and D. dorsal and ventral views of larval shells just after hatching; E and F. dorsal and ventral views of 48-h larval shells.

Egg Masses

Cerithium sinensis: The spawn of *C. sinensis* is described here for the first time. However, NATARAJAN (1957) earlier reported the spawn of an unidentified species of *Cerithium* from the Gulf of Manaar (India) that closely resembles the present egg mass.

Table 1

Dimensions of eggs and larval shells of *Cerithium sinensis* and *C. morus* at various stages of development. The values in the table are means ± 1 standard deviation, followed by the number of observations in parentheses.

	Cerithium sinensis	*Cerithium morus*
Egg diameter (µm)	94 ± 6.75 (19)	99 ± 5.49 (16)
Incubation period (days)	4–5 ± 0.49 (7)	3–4 ± 0.55 (5)
No. eggs/mass	5438	10,490
Larval shell height at hatching (µm)	160 ± 10.5 (25)	132 ± 8.45 (18)
Larval shell width at hatching (µm)	120 ± 5.88 (25)	113 ± 9.10 (18)
Larval shell height after 48 h (µm)	187 ± 4.99 (18)	176 ± 5.47 (16)
Larval shell width after 48 h (µm)	149 ± 5.93 (18)	145 ± 11.11 (16)
Larval shell height after 13 days (µm)	—	246 ± 13.03 (5)
Larval shell width after 13 days (µm)	—	219 ± 9.56 (5)

Deposition of egg masses of *C. sinensis* occurred at night. In the morning, laying of the egg masses was found to have been completed, indicating that these were deposited without interruption. They were usually deposited on the bottom of the containers. The two egg masses that were obtained from the field were collected from the sandy layer covering the surface of rocks.

The spawn of *C. sinensis* (Figure 1A) consisted of loosely coiled, or straight, long thin white tube-like strings. The strings measured on an average 1 mm wide and 67 mm long (SD = 15.28, N = 5). Free-swimming veligers hatched from these egg masses 4–5 days after their deposition. Dimensions of eggs and larvae at various stages of development are given in Table 1. At hatching the outer lip of the larval shell was extended in the middle and became more pronounced as the shell grew.

Cerithium morus: The spawn of *C. morus* was earlier described by NATARAJAN (1957) from the Gulf of Manaar (India).

In the present study the egg masses of *C. morus* were found to be deposited at night on the side walls of the glass bowls and only occasionally (in one out of ten cases) on the bottom. At spawning, the egg masses consisted of a narrow transparent, colorless, gelatinous tube, 0.5 mm wide and 92–196 mm long (SD = 35.22, N = 7), forming several coils compactly arranged and touching each other at several points. In one case the spawned mass covered

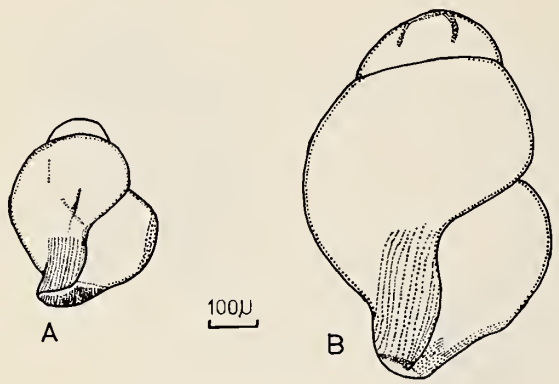

Figure 3

Cerithium sp. A. Larval shell 24 h after hatching; B. larval shell 96 h after hatching.

an area 25–36 mm long and 5–7 mm wide. The eggs were contained in egg capsules which were embedded in the gelatinous material of the egg mass. The eggs were more-or-less spherical, and so were the individual egg capsules (Figure 2B).

Larvae hatched from the capsules as free-swimming veligers (Figure 2C). At room temperature, which ranged from 28 to 31.5°C with an average of 30.2°C (SD = 0.92), the incubation period was 3–4 days but extended to 8 days in some cases. At hatching the larvae possessed transparent sculptureless shells. Subsequently, their outer lips formed a beaklike structure and developed a few striations; the umbilicus became more distinct. They survived in the laboratory for 15 days without food. At this stage their shells became thick and vertical striations became prominent.

Cerithium sp.: Five miniature snails of this species were found swimming actively in the finger bowls on the morning of October 14, 1976. The bowls were searched carefully for egg capsules, but none were found. Evidently, these juveniles had been extruded at night by the specimens placed for spawning. This species, therefore, seems to be ovoviviparous and its larvae seem to have direct development. The juveniles resembled the adults in the shape of their shells, which in both had a projected and recurved siphonal canal. The juvenile shells had translucent thick walls and were composed of two and a half whorls (Figure 3A). They survived in the laboratory for four days without food, and measured 798 μm high and 599 μm wide (Figure 3B). They were preserved alive after four days for future study. By this time, axial ribs started appearing on the projected siphonal canal.

DISCUSSION

Cerithium sinensis and *C. morus* spawn on the coast of Karachi during the monsoon and postmonsoon season from June to December. The single instance of spawning observed in the unidentified species of *Cerithium* from Karachi (in October) indicates that it also spawned during the postmonsoon season. On this coast the gastropod *Planaxis sulcatus* was found to breed from January to August (Barkati & Ahmed, 1982) and four species of *Thais* in spring and summer (Barkati & Ahmed, 1983). Ahmed (1980) has categorized the marine organisms of the coast of Pakistan from the standpoint of their spawning seasons, as monsoon, winter-spring, spring-summer, and year-round spawners. The three species of *Cerithium* do not seem to fit this scheme. Knowledge of the spawning of these species, however, is based mostly on the deposition of egg masses in the laboratory, and may not truly reflect the situation prevailing in the field. The spawning season of *C. sinensis,* which occurs very low in the intertidal zone, might be expected to extend to the winter and spring months, or even throughout the year. This would conform with the conclusion, drawn by Ahmed in his recent review (1980), that marine organisms of the coast of Pakistan (a subtropical coast) that occur close to the low tide mark or subtidally have a tendency to spawn in the winter and spring months and in some cases throughout the year.

The nature of the larval development of the three species needs further consideration. It is known that indirect development is the usual method of reproduction in members of the genus *Cerithium* compared to direct development, which has so far been reported from only two species, namely *C. muscarum* and *C. variabile* (Houbrick, 1973). The three species of *Cerithium* reported herein can be placed in two groups according to their mode of development. In the first type, the egg mass consists of filaments containing egg capsules from which free-swimming larvae hatch, as in *C. sinensis* and *C. morus*. The second type is represented by *Cerithium* sp. in which miniature snails hatch directly from the parent. In this case, juvenile snails settled on the bottom after only a brief period of swimming. Although this is the first time a species of *Cerithium* has been found to possess viviparous development, this mode of development is not new to the present environment: another prosobranch, *Planaxis sulcatus,* has recently been shown to be viviparous. Thus, the observations made during the present study show that, in addition to the usual method in which gelatinous filaments containing egg capsules are produced, extrusion of juveniles from the mother snails may also occur.

The number of eggs per spawn has been described earlier for a number of species of *Cerithium* (see Houbrick, 1973). This ranges from 8800 in *C. literatum* to 90,000 in *C. auricoma*. The spawns of *C. morus* and *C. sinensis* were found in the present study to contain an average of 10,490 and 5438 eggs, respectively. The number of eggs per spawn in *C. sinensis,* therefore, is the lowest of all the *Cerithium* species studied so far.

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